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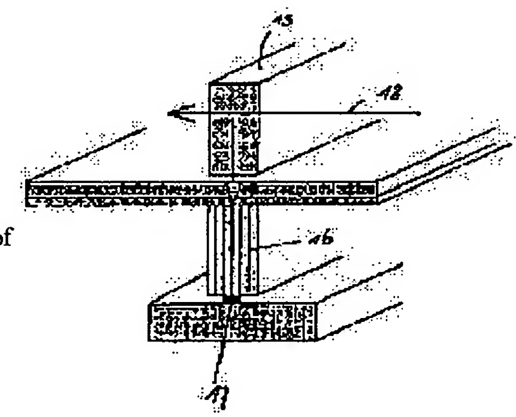
(54) **METHOD FOR READING RADIOGRAPHIC IMAGE AND UNIT THEREFOR**

(57)Abstract:
PROBLEM TO BE SOLVED: To reduce radiation energy in a light excitable phosphorescent screen to such an appropriate amount that the screen can be reused in subsequent recording by using a specified cesium halide phosphorescent material and obtaining light for erasure from an electroluminescent lamp.
SOLUTION: The reading unit has a linear light source 15 for radiating light for excitation on a light excitable phosphorescent screen. The light source 15 has aligned laser diodes and light emitted from the diodes is projected on the screen through a cylindrical lens. The reading unit has an optical fiber plate 16 for guiding light emitted from the screen by excitation to an array of charge-coupled devices 17. The screen contains a cesium halide phosphorescent material activated with divalent europium, the halide is one of a chloride and a bromide and light for erasure is emitted from at least one electroluminescent lamp.



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CLAIMS

[Claim(s)]
[Claim 1] It is how to read the radiation picture memorized by the phosphorescence screen in which a luminous stimulus is possible. (1) Stimulate the aforementioned phosphorescence screen by radiation for a stimulus, and the light which came out of the phosphorescence screen on the occasion of (2) stimuli is detected. And change the detected light into signal expression of the aforementioned radiation picture, and it consists of many stages eliminated by exposing the (3) aforementioned phosphorescence screen to the light for elimination. (4) Including the halogenation caesium phosphor by which the aforementioned phosphor was activated with the europium of two loads, a chloride and the bromide of the aforementioned halogenide are one side at least, and the light for the (5) aforementioned elimination emits light with one electroluminescence lamp at least. [Claim 2] It is equipment for reading the radiation picture memorized by the phosphorescence screen in which a luminous stimulus is possible. - Radiation Source for Stimulus Arranged so that Light for Stimulus May be Given Off and the Aforementioned Light May be Turned on Phosphorescence Screen in which Luminous Stimulus is Possible, - Converter for Changing into Electrical Signal Light Which Came out of the Aforementioned Phosphorescence Screen on the Occasion of Stimulus, - It Has Elimination Unit for Eliminating Phosphorescence Screen in which the Aforementioned Luminous Stimulus is Possible after being Stimulated. - The aforementioned halogenide is the aforementioned reader in which a chloride and a bromide are one side at least, and the - aforementioned elimination unit has an electroluminescence lamp including the halogenation caesium phosphor by which the aforementioned screen was activated with the europium of two loads.
[Claim 3] It is a reusable radiation detector. The phosphorescence screen in which - luminous stimulus is possible, - it Has been Arranged in order to Stimulate the Aforementioned Phosphorescence Screen -- at Least -- One Light Source for Stimulus -- - Array of Converter Element Arranged in order to Capture Light Which Came out of the Aforementioned Phosphorescence Screen on the Occasion of Stimulus and to Change the Aforementioned Light into Electrical Signal Expression, - Elimination Unit Equipped with Electroluminescence Lamp Arranged so that the Aforementioned Phosphorescence Screen May be Illuminated, when Excited, - Means for Conveying Assembly of Array of Light Source for Stimulus, Elimination Unit, and Converter Element about Phosphorescence Screen, - The detector possessing the interface means for [which encloses and communicates the - aforementioned electrical signal expression to an external signal processor] having surrounded the aforementioned means for conveying the phosphorescence screen in which the aforementioned luminous stimulus is possible, the light source for a stimulus, an elimination unit, the aforementioned assembly of the aforementioned array of a converter element, and the aforementioned assembly.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the method and system which read the radiation picture memorized by the phosphorescence screen which can carry out a reuse, and in which a luminous stimulus is possible. this invention relates to a still more nearly reusable radiation detector.
[0002]
[Description of the Prior Art] The radiation image recording system by which a radiation picture is recorded on the aforementioned screen is widely used now by exposing the phosphorescence screen in which a luminous stimulus is possible to the transparency radiation modulated in the shape of a picture.
[0003] The recorded picture stimulates the exposed phosphorescence screen in which a luminous stimulus is possible by the means of the radiation for a stimulus, and is reproduced by detecting the light which came out of the phosphorescence screen on the occasion of a stimulus, and changing this detected light into electrical signal expression of a radiation picture further.
[0004] In this system, it is desirable that the phosphorescence screen which can be stimulated can be used in the imaging cycle of many times from the point of economical efficiency.
[0005] When the radiation picture memorized previously is eliminated by sufficient amount, the reuse of the phosphorescence screen which can be stimulated is possible.
[0006] When a picture is read by scanning the phosphorescence screen exposed to transparency radiation, 90% or less of the memorized energy is eliminated. Therefore, in the case of a reuse, in addition, a part of radiation picture is memorized by the phosphorescence screen, and the problem that it may appear in the following picture as the so-called ghost image arises.
[0007] In a general medical radiograph, a picture is made from the wide range different amount of X-ray irradiation.
[0008] For example, for making the picture of an end like a finger, an exposure is the order of 1mR. On the other hand, the picture of an internal organ like the stomach is made from the exposure of a lot of X-rays like 300mR.
[0009] When making the picture of 1mR immediately after the picture of 300mR(s), in order to avoid a ghost's generating, you have to reduce the signal of the first picture or less to 1/300.
[0010] As for the dynamic range in the 2nd picture, as a practical question, it is desirable that it is 100 at least. It means that this must reduce at least the signal made from the 1st irradiation to 1/3.104, and is equivalent to this requiring the elimination depth of 1/(3-104) =3.3 and 10-5.
[0011] USP According to No. 3859527 (a column 4, five to seven lines), a phosphor can be changed into a natural state by uniform lighting, irradiation, or operation like heating.
[0012] A phosphorescence screen is eliminated by irradiation of a visible ray in a commercial system.
[0013] Usually, since an incandescent lamp is the cheap high power light source, it is used. Since it will not become if a phosphorescence screen is eliminated for a short time and kicked 7 in order to guarantee the high productivity of a scanning system, the high power light source is selected. However, a high power lamp may produce heat loss and may reduce the stability of the scanner with which this reads the memorized phosphorescence screen. The size of a reader cannot but become large in order to fully remove the heat which a high power lamp generates.
[0014] Furthermore, when an incandescent lamp is used for the elimination unit of a phosphorescence reader, the size of a phosphorescence elimination unit is decided with the size (specially diameter) of an incandescent lamp.
[0015]
[Objects of the Invention] It is the purpose of this invention to offer the radiation picture reading method and system which reduce the radiant energy in the phosphorescence screen in which a luminous stimulus is possible in a suitable size so that it may be between the continuing records and the reuse of a screen may be made.
[0016] While it is small, it is another purpose of this invention to offer the system which has high productivity.
[0017] In addition, another purpose is offering a small reusable radiation detector.
[0018] The further purpose will become clear from the explanation given below.
[0019]
[Means for Solving the Problem] this invention is how for many above-mentioned purposes to read the radiation picture memorized by the phosphorescence screen in which a luminous stimulus is possible. (1) Stimulate the aforementioned phosphorescence screen by radiation for a stimulus, and the light which came out of the phosphorescence screen on the occasion

of (2) stimuli is detected. And change the detected light into signal expression of the aforementioned radiation picture, and it consists of many stages eliminated by exposing the (3) aforementioned phosphorescence screen to the light for elimination. (4) The halogenation caesium phosphor by which the aforementioned phosphor was activated with the europium of two loads is included. A chloride and the bromide of the aforementioned halogenide are one side at least, and it found out that light for the (5) aforementioned elimination was realized by the aforementioned reading method which emits light with one electroluminescence lamp at least.
[0020] In this document, he should understand the term "radiation" as proper transparency radiation, and it includes the radiation from the sample displayed by the irradiation from radioisotope (for example, 60Co, 192Ir, 75Se, etc.), the radiation suitably made with the X-ray generator of form, the radiation made with the high-energy radiation generator (for example, betatron), and the high energy particle, for example, radioisotope like [in the case of autoradiography].
[0021] An electroluminescence lamp can be made into the form of an electroluminescence film based on an inorganic electroluminescence phosphor, for example, ZnS:Mn, or can be made into the form of an electroluminescence film based on organic light emitting diode (OELD).
[0022] Use of the electroluminescence lamp in this invention has an advantageous point ideal as an object for lighting with these uniform lamps.
[0023] These lamps offer the uniform lighting covering the whole lamp surface, abolishing the need for a socket, an electric bulb, a diffuser, and a reflector. This lamp is a source of a luminescence, therefore there is almost no heat applied to an assembly.
[0024] As for a great portion of luminescence equipment, brightness changes according to a direction. An electroluminescence lamp is essentially the same brightness regardless of an angle, namely, an electroluminescence lamp is the Lambert photogenic organ.
[0025] Furthermore, electroluminescence Lambert can have and make the luminescence side of the same size as the field of the phosphorescence screen which should be eliminated. A phosphorescence screen is eliminable by the thereby very uniform method.
[0026] Since it is thought that an electroluminescence lamp is inadequate for obtaining sufficient elimination depth which the reuse of the phosphorescence screen in which the output of the light source is low, therefore its luminous stimulus is possible cuts in spite of it, there is prejudice over use of this lamp as the light source for elimination in the reading system of the phosphor in which a luminous stimulus is possible.
[0027] By use of a special phosphor and the halogenation caesium phosphor (there are also little chloride and bromide and this halogenide is one side) more specially activated with the europium of two loads, this invention is low power and found out that elimination to sufficient amount was obtained with a small electroluminescence lamp. By this method, an eraser can be made very small nothing with a bird clapper for a long blanking time, therefore low productivity.
[0028] Another mode of this invention is related with a radiation picture reader which was explained to an embodiment 8 or 12.
[0029] Since the elimination unit equipped with the electroluminescence lamp is small, it is suitable for the nest to the radiation detector by this invention.
[0030] Furthermore, another mode is related with a radiation detector which was explained to the embodiment following an embodiment 13 and this.
[0031] The special feature about the desirable example of this invention is clarified in an embodiment.
[0032] In the 1st example of the method by this invention, a system, and a detector, the electroluminescence lamp based on ZnS:Mn, ZnS:Cu, CaS:Eu, and an inorganic electroluminescence phosphor like CaS:Ce is used, for example.
[0033] These electroluminescence lamps can have the optical power to about 0.3 mW/cm2.
[0034] Furthermore, the elimination spectrum of a phosphor can be made to adjust the spectrum of the light which comes out of an electroluminescence lamp by adjusting composition of a phosphor, and the operation frequency of a lamp. Then, the bigger elimination depth than an incandescent lamp is obtained by the same optical power, an electroluminescence lamp having a smaller size and fewer heat leakage.
[0035] Furthermore, requiring the light energy of 10 mJ/cm2 will be explained in order to fully eliminate a CsBr;Eu2+ phosphor. This means that a CsBr;Eu2+ phosphor is eliminable in about 35 seconds with an electroluminescence lamp.
[0036] The energy of 100 times or more will be required of elimination at least, when the energy required for eliminating the commercial BaFBr:Eu2+ phosphorescence screen shown by brand-name MD-10 of Agfa violence N.V. compares. This is equivalent to the blanking time of about 1 hour. This prolonged elimination process will not be accepted to the commercial purpose.
[0037] It is still more advantageous to use an electroluminescence lamp combining a CsBr;Eu2+ phosphor at the point of offering very uniform elimination within an elimination unit with this small combination.
[0038] Compared with the case where a BaFBr:Eu2+ phosphor is used, the same result is only obtained in very long time, and this is very un-practical.
[0039] Elimination of a CsBr;Eu2+ phosphorescence screen can be performed in the small elimination unit in a digitizer. However, with a flat electroluminescence lamp, elimination can also be extremely performed in the cassette by which the storage phosphorescence screen was stored, or a box. A reusable radiation detector can be made by this method.
[0040] An organic electroluminescence lamp (OELD) is used in the 2nd example. Although costs start more as for the electroluminescence lamp of this form, since [which can shorten a blanking time more like] it will be explained below, the lamp of this form fits the use in the elimination unit of a storage phosphor further.

[0041] Organic electroluminescence equipment is carried out based on either the small organic molecule by which vacuum evaporation was carried out, or polymer. The former organic electroluminescence lamp is usually called OELD, and the latter is called polymer ELD.
[0042] The easiest organic electroluminescence lamp consists of a single layer between two suitable contact objects. To a hole-injection anode plate, ITO (in JUMU stannic-acid ghost) is often used, and, on the other hand, an Mg-Ag alloy, aluminum, or calcium is used to electron-injection cathode.
[0043] The operation is as follows. In an organic electroluminescence lamp, it is poured in into an insulating layer to say which are an electron and an electron hole, and these are recombined through this progress and emit a photon.
[0044] An organic electroluminescence lamp has a film (about 100nm) very much, and voltage is a low (<10V).
[0045] Organic electroluminescence equipment reaches the efficiency of about 2 mW/cm2 on the voltage of about 10 V. This means that the optical power of this equipment is the size of a digit higher than the optical power of an inorganic electroluminescence lamp. Therefore, a blanking time can be reduced in the size of a certain digit with organic electroluminescence equipment, and this shortens a blanking time at about 5 seconds. This elapsed time suits to the use in the actual commercial scanner for storage phosphorescence screens.
[0046] Another mode of this invention is related with use of the light emitting diode (Light Emitting Diode) as the light source for elimination in the method, system, and detector which read a phosphor which was explained to embodiments 4, 9, and 14, and in which a luminous stimulus is possible.
[0047] The array of light emitting diode is almost similarly [to an electroluminescence lamp] small, and, in addition, has optical larger power. This means that light emitting diode is very suitable for the composition of the small elimination unit which will eliminate the phosphorescence board very uniformly.
[0048] elimination to amount sufficient in a short time can be obtained by low-power output and small light emitting diode by use of a special phosphor and the halogenation caesium (on the other hand, a chloride and a bromide come out of this halogenide at least) more specially activated with the europium of two loads It can make very small, without a blanking time being long in an eraser, therefore making productivity low by this method.
[0049] The light emitting diode of a 3mmx3mm size can have the brightness to 500mCd. Probably, the array of this light emitting diode has the optical power of 5 Cd/m2. This is equivalent to about 50 mW/cm2.
[0050] Therefore, in order to eliminate + in CsBr:Eu2 5 seconds, luminescence area can use the elimination unit made from the LED array of 2 about 60cm. Or in order to eliminate a 43cmx35cm CsBr:Eu2+ screen in 1 second, the LED array of 2 can be used a luminescence area of 300cm.
[0051] this invention -- and -- the -- it is explained in the special detailed explanation to which/or a desirable example is given below by reaching The special mode will be illustrated by the drawing enumerated below.
[0052]
[Detailed description of invention] One example of the reader by this invention is shown in drawing 1 . This example is called scanning head type.
[0053] A reading unit is equipped with the linear light source (15) for emitting the light for a stimulus on the phosphorescence screen in which a luminous stimulus is possible.
[0054] This linear light source is equipped with ten to 20 arranged at the single tier individual laser diodes, and the light which came out is projected on a screen through a cylinder-like lens.
[0055] the light to which the reading unit came out of the phosphorescence screen on the occasion of a stimulus -- a sensor element -- more -- special -- the line of a charge-coupled device (17) -- it has an optical-fiber plate (16) for turning on an array An optical-fiber plate (16) is equipped with the fiber for optical guidance of parallel anchoring of a large number arranged so that the light given off by the element according to each [of each irradiated line] may be guided on a sensor element.
[0056] Or an optical-fiber plate can be replaced by arrangement of a selfoc lens or a micro lens.
[0057] a line -- another thing can also be considered to the light sources this line -- the "premature start spot (flying spot)" light source can replace the light source The light which came out of this light source is deflected by for example, the rotation polygon mirror on the scanning line of a phosphorescence screen. One on this line is irradiated by timely by this method.
[0058] the example shown in drawing 3 -- setting -- one phosphorescence screen side -- a line -- the light source arranges -- having -- an opposite side -- the line of an optical-fiber plate and a sensor element -- an array is arranged Each of these many members is extended in the direction of the scanning line.
[0059] Among read, a phosphorescence screen is related mutually [the assembly of an optical-fiber plate and a sensor array] in the direction of an arrow (18), and is moved to one side again at an another side side.
[0060] In still more nearly another example which is not illustrated, the array, optical-fiber plate, and sensor array of the light source for a stimulus are arranged at the same phosphorescence screen side in which a luminous stimulus is possible.
[0061] The energy which remains in the phosphorescence screen in which the luminous stimulus of the phosphorescence screen in which a luminous stimulus is possible is possible after reading is eliminated after reading, therefore a screen is in the state where a reuse can be carried out.
[0062] the line extended to the scanning line on the phosphorescence screen which can be stimulated, and parallel -- as for an elimination unit, in the reader of form that a stimulus is performed by the means of the light which came out of the light source, it is desirable to form the portion of a reading unit
[0063] In the example shown in drawing 1 , the light source for elimination is the portion of the assembly equipped with the light

source for a stimulus, optical guidance, and the both-hands stage of a photodetection. The position of the light source for a stimulus and the position of the light source for elimination are shown in drawing 2 in graph.

[0064] In one example of this invention, as for an elimination portion, the wavelength range is equipped with the rectangle array of 600 to 750nm Light Emitting Diode by luminescence area among 2 300cm from 15. Depending on the blanking time of hope, if area becomes large, as for this necessary area, the necessary blanking time will become short. The number of Light Emitting Diodes in an array is 50 to 2000 order typically depending on the size of Light Emitting Diode.

[0065] the array of light emitting diode -- the line of the light source for a stimulus -- it is arranged at an array and parallel The array of the light source for elimination and the light source for a stimulus passes the picture which is the same transportation speed between 250 mm/sec, and is read in 30 mm/sec, and is conveyed. By this method, the light source for elimination irradiates one line of a picture [finishing / read].

[0066] An elimination unit is equipped with an electroluminescence lamp in another example by this invention. The lamp of this form constitutes a flat luminescence side as it says well. This field or zone can offer the separated elimination unit, and after reading, a phosphorescence screen is conveyed through this unit so that it may be eliminated with the light which came out of this electroluminescence lamp.

[0067] However, another example can also be planned. An electroluminescence lamp can be made a part [for example, the assembly for reading itself]. Moreover, for example, suppose a part [covering of equipment]. In this example, an electroluminescence lamp is operated after completion of read.

[0068] Another mode of this invention is related with a reusable radiation detector. The detector of this form is shown in drawing 3 .

[0069] This detector is enclosed and is equipped with (22).

[0070] The phosphorescence screen (23) in which a luminous stimulus is possible is placed into this enclosure. This screen is desirable, there are also little chloride and bromide including 2 load halogenation caesium phosphor, and this halogenide is one side. This phosphor has a very good elimination property, and, in addition, offers the optimal sharpness further.

[0071] An enclosure is further equipped with the array (25) of the converter element for catching the light which has been arranged in order to stimulate the aforementioned phosphorescence screen and which came out from the phosphor at least on the occasion of the one light source for a stimulus (24), and a stimulus, and changing this light into electrical signal expression. the shown example -- setting -- the linear array of the light source for a stimulus -- the array of laser diode is used more specially the shown example -- a converter element -- it has the linear array of a charge-coupled device more specially

[0072] An enclosure is further equipped with the light source for elimination.

[0073] In one example, it is the linear light source for elimination (26), and the wavelength range is 600 to 750nm more specially, and the light source for elimination is the array of 50 to 2000 which covers the luminescence area of 2 300cm from 15 individual light emitting diodes. This array is substantially arranged in parallel with the light source for a stimulus.

[0074] In another example, the light source for elimination is an electroluminescence lamp arranged so that the whole surface product of a phosphorescence screen can be illuminated at the time of an operation. This lamp is operated after the read of a screen finishes.

[0075] The lamp of this form can be formed in the inside of the portion of the enclosure (22) which faced the phosphorescence screen in which a luminous stimulus is possible. This example can be made very small.

[0076] Or installation of the elimination unit which adjoins and puts the separated elimination unit on a reading unit, and conveyed the screen to the elimination unit from the reading unit is possible.

[0077] An enclosure is further equipped also with the means (not shown) for conveying the light source for elimination about a phosphorescence screen in the so-called direction of vertical scanning shown by the arrow (28) depending on the assembly (27) of the array of the light source for a stimulus, and a converter element, and the case.

[0078] The means (29) for communicating the output of the electrical signal expression by the array of a converter element to an external signal processor is established further.

[0079] In this example, the array of the light source for a stimulus and a converter element is arranged at the both sides of a phosphorescence screen.

[0080] In another example, these things can be arranged to the same phosphorescence screen side.

[0081] The phosphorescence screen which can stimulate several sorts of examples of this invention is equipped with 2 load europium activation halogenation caesium phosphor. This phosphor is known in this technology, for example, is made clear to EP-A -174875 [No. (and US 5028509 No.)]. This phosphor is well suitable for manufacture of a "with [no binder]" phosphorescence screen especially. A binder-less phosphorescence screen offers the optimal configuration. These have very good erasability ability, as shown later.

[0082] When X is the halogenide obtained from the group which consists of Br and Cl, use of the CsX:Eu phosphor obtained by the following methods is advantageous.

- the time of being selected from the group which X' becomes from F, Cl, Br, and I -- EuX -- the europium compound selected from the group which consists of '2, EuX'3, and EuOX' -- between 10-three to five-mol % -- CsX -- mixing - burn this mixture at the temperature of 450 degrees C or more, and cool the - aforementioned mixture, and collect -CsX:Eu phosphors

[0083] The phosphor obtained as a result of the upper process has a big conversion efficiency as compared with 2 load europium activation halogenation caesium phosphor of the present technology. This phosphor can be stimulated by the means of more nearly little stimulus energy.

[0084] The phosphorescence screen which is using this phosphor and in which a luminous stimulus is possible is preferably obtained by the following method.
[0085] - When it is Halogenide Selected from Group Which X' Becomes from F, Cl, Br, and I, A CsX:Eu phosphor is prepared by burning mixture with the above CsX whose europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX' is between 10-three to five-mol %. - Apply the aforementioned phosphor on a substrate by the method selected from the group which consists of physical vacuum evaporationo and heat vacuum evaporationo, chemical vacuum evaporationo, and RF deposition and pulse-ized laser deposition.
[0086] Since a phosphor can deposit this manufacture method in the form of needle crystal, it is advantageous. These needle crystal acts as a guide of light, therefore diffusion of the longitudinal direction of the light in a phosphorescence layer is reduced. Reduction of diffusion of a lateral light produces the picture of higher resolution.
[0087] Or a phosphorescence screen contains the CsX:Eu phosphor which can be stimulated. X can express the halogenide selected from the group which consists of Br and Cl here, and this phosphor can be manufactured by execution of many following stages.
[0088] - When it is Halogenide Selected from Group Which X' Becomes from F, Cl, Br, and I in State for Vacuum Evaporationo, The europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX', and the multiple container (multiple container) of Above CsX are brought about. - By Method Selected from Group Which Consists of Physical Vacuum Evaporationo and Heat Vacuum Evaporationo, Chemical Vacuum Evaporationo, and Electron Beam Deposition, RF Deposition, and Pulse-ized Laser Deposition Both above CsX and aforementioned europium compound are made to deposit on a substrate by ratio in which the CsX phosphor by which the europium compound was doped between 10-three to five-mol % is formed on the aforementioned substrate.
[0089] Since this manufacture method can deposit a phosphor in the form of needle crystal, it is advantageous. These needle crystal acts as a guide of light, therefore diffusion of the longitudinal direction of the light in a phosphor layer is reduced. Reduction of diffusion of a lateral light produces the picture of higher resolution.
[0090] The method of making the specific phosphor and this which were mentioned above is clarified in the U.S. provisional application 60/No. 159004 incorporated here as bibliography, and No. 60/142276.
The erasability ability of the measurement CsBr:Eu screen of erasability ability was compared with the commercial MD-10 (brand name) BaFBr:Eu screen from AGUFAGE Die Welt N.V.
The process CsBr:Eu screen of a sample was manufactured by the following methods.
[0091] The CsBr:Eu screen of a sample was made by the heat vacuum evaporationo of CsBr and EuOBr. For this purpose, CsBr was mixed with EuOBr and it was placed into the container of the vacuum deposition interior of a room. The phosphor was deposited on the glass disk with 1.5mm [in thickness], and a diameter of 40mm. The distance between a container and a substrate was 10cm. The substrate was turned by 12rpm during vacuum evaporationo.
[0092] The temperature of the substrate at the time of the start of vacuum evaporationo processing was about 200 degrees C.
[0093] The container was heated by the temperature of 750 degrees C.
[0094] The container was decompressed by 4-10 - 5mb before the start of vacuum evaporationo. Ar was indoors introduced during vacuum evaporationo processing, and the pressure of Ar gas was 1.6-10 - 2mb.
[0095] The obtained screen was 850micro in thickness.
[0096] Eu concentration of the screen by which vacuum evaporationo was carried out was measured by the X-ray phosphorescence. The phosphor contained 800 ppm Eu in the 400 ppm front-face side in the side of a substrate.
In measurement-procedure the 1st measurement, both screens were irradiated by the exposure of about 50 mR(s) by 80kVp(s).
[0097] The screen was read by the flying spot scanner. The light source for a scan was 30mW diode laser which emits light by 690nm. In order to separate stimulus light from the light which came out of the phosphorescence screen, it is 4mm Hoya. BG-39 (brand name) filter was used. Scanning average level (SAL) was decided as an average signal made by the screen of an optical redoubling pipe. This measurement result is the value of SAL1 to CsBr:Eu2+, and SAL1 to MD-10 screen (Table 1).
[0098] In the 2nd measurement, MD-10 screen was similarly irradiated uniformly by the exposure of about 44 R in 80kVp(s).
[0099] Subsequently, the screen was eliminated for 1 second using the quartz halogen lamp of 500W (power). The intensity of light in a screen position was measured using the photometer, and was 12 mW/cm2.
[0100] The screen was read after elimination using the above-mentioned scanner, and SAL was measured. The value of SAL2 to MD-10 screen was acquired from this measured value (Table 1).
[0101] The elimination depth defined as a value broken by SAL before measuring SAL after elimination was calculated from the following formula.
[0102]
2x50/(SAL 1x44000) of Ed=SAL (1)
Coefficients 50/44000 amend the difference of an exposure with measurement 1 and 2 here (an exposure which is different so that detection of a picture can be performed without the need of fitting a sensitivity setup of an optical redoubling pipe in all cases was chosen).
[0103] In the 3rd measurement, the CsBr:Eu2+ screen was uniformly stimulated by the exposure of about 166 R by 80kVp(s) also in this case.
[0104] Next, the screen was eliminated for 1 second using the 500W quartz halogen lamp. The intensity of light [in / a screen / in this case] was 12 mW/cm2.

[0105] The screen was read after elimination using the above-mentioned scanner, and SAL was measured. The value of SAL3 to a CsBr:Eu2+ screen was acquired from this measured value (Table 1).
[0106] The elimination depth defined as a value broken by SAL before measuring SAL after elimination was calculated using the following formula.
[0107]
3x50/(SAL 1x166000) of Ed=SAL (2)
Coefficients 50/166000 amend the difference of an exposure with measurement 1 and 3 here.
[0108]
[Table 1]
表1 MD-10及びCsBr ： Eu^{2+}スクリーンに対するSAL測定値とEd計算値

	MD-10 BaFBr:Eu^{2+}	CsBr:Eu^{2+}
SAL1	440	1,180
SAL2	2,800	
SAL3		290
Ed	7.10-3	7.10-5

[0109] It is clear that CsBr:Eu has erasability ability better than a commercial BaFBr:Eu2+ phosphor. Therefore, in order to eliminate a CsBr:Eu2+ storage phosphorescence screen, only a fewer irradiation output is required.
[0110] Therefore, the purpose of this invention can be attained by making the imaging system based on CsBr:Eu instead of BaFBr:Eu.
[0111] In the 4th-set measurement, the CsBr:Eu2+ screen was eliminated in a source of the homogeneous light which is expressed with elimination with an electroluminescence lamp.
[0112] For this purpose, the laser which emits light by 685nm was used, and the beam was developed so that the strength of 0.125 mW/cm2 might be given on the screen which should be eliminated.
[0113] In the 1st measurement, the screen was uniformly irradiated by the exposure of 48mR(s) in 80kVp(s).
[0114] The screen was read with the above-mentioned scanner, and SAL was determined. The value of SAL41 to a CsBr:Eu screen was acquired from this measured value (Table 2).
[0115] Next, the CsBr:Eu screen was uniformly irradiated by the exposure of the range of 167mR(s) to 115R, and was eliminated by the laser construct in 1 or 100 seconds (Table 2).
[0116] The screen was read after elimination using the above-mentioned scanner, and SAL was measured. The value of SAL42 given to Table 2 or SAL48 was acquired from these measurement.
[0117] The elimination depth defined as a value broken by SAL before measuring SAL after elimination was calculated using the following formula.
[0118]
Ed=SAL4xx50/(SAL41x exposure (x)) (2)
Coefficient 50 / exposure (x) amends the difference of the exposure in the case of measurement here.
[0119]
[Table 2]
表2 685nmでの単色消去に対するCsBr ： Eu^{2+}スクリーンについてのSAL測定値とE_d計算値

測定	X線照射量 (mR)	消去時間 (s)	SAL (V)	E_d
41	48	0	917	1
42	167	1	842	$2.6\ 10^{-1}$
43	167	2	399	$1.3\ 10^{-1}$
44	234	5	142.5	$3.2\ 10^{-2}$
45	1,026	10	95.6	$4.9\ 10^{-3}$
46	25,400	20	323	$6.6\ 10^{-4}$
47	50,500	50	53.4	$5.5\ 10^{-5}$
48	115,000	100	17	$7.7\ 10^{-6}$

[0120] The result of Table 2 shows that the blanking time for about 80 seconds is required for reaching the elimination depth 3-10-5 of hope in the used composition.
[0121] The strength of elimination is 0.125 mW/cm and this is equivalent to necessary elimination power 10 mW/cm2.
[0122] When putting in another way and the monochromatic light source for elimination or the light source for elimination which has a comparatively narrow emission spectrum is used for elimination of a CsBr:Eu screen, and when the wavelength of elimination is within the limits of the stimulus spectrum of CsBr:Eu ranging from 600 to 750nm, the optical power of about 10 mW/cm2 is required to reach the elimination depth 3-10-5 of hope.
[0123]
[Example] 1. It is How to Read Radiation Picture Memorized by Phosphorescence Screen in which Luminous Stimulus is Possible. (1) Stimulate the aforementioned phosphorescence screen by radiation for a stimulus, and the light which came out of the phosphorescence screen on the occasion of (2) stimuli is detected. And change the detected light into signal expression of the aforementioned radiation picture, and it consists of many stages eliminated by exposing the (3) aforementioned phosphorescence screen to the light for elimination. (4) The halogenation caesium phosphor by which the aforementioned phosphor was activated with the europium of two loads is included. It is the aforementioned reading method that a chloride and the bromide of the aforementioned halogenide are one side at least, and the light for the (5) aforementioned elimination emits light with one electroluminescence lamp at least.
[0124] 2. Method by embodiment 1 based on inorganic electroluminescence phosphor in aforementioned electroluminescence lamp.
[0125] 3. Method by embodiment 1 based on organic electroluminescence phosphor in aforementioned electroluminescence lamp.
[0126] 4. How to read radiation picture light for aforementioned elimination was remembered to be by phosphorescence screen by embodiment 1 of light emitting diode changed so that light might be emitted by one array at least in which luminous stimulus is possible.
[0127] 5. the time of the aforementioned phosphor being selected for -X' from the group which consists of F, Cl, Br, and I -- EuX -- the europium compound selected from the group which consists of '2, EuX'3, and EuOX' -- between 10-three to five mol % -- CsX -- mixing -- - -- the method by the embodiment 1 which burns this mixture at the temperature of 450 degrees C or more, and cools the - aforementioned mixture, and is acquired according to many stages collect -CsX:Eu
[0128] 6. When Aforementioned Phosphorescence Screen is [-X'] Halogenide Selected from Group Which Consists of F, Cl, Br, and I, When the europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX' burns mixture with Above CsX between 10-three to five-mol %, the aforementioned CsX:Eu phosphor is prepared. - The method by the embodiment 5 acquired according to many stages which apply the aforementioned phosphor on a substrate by the method selected from the group which consists of physical vacuum evaporationo and heat vacuum evaporationo, chemical vacuum evaporationo, and RF deposition and pulse-ized laser deposition.
[0129] 7. When it is Halogenide by Which Aforementioned Phosphorescence Screen was Selected from Group Which X' Becomes from F, Cl, Br, and I in State for - Vacuum Evaporationo, The europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX', and the multiple container of Above CsX are brought about. - By Method Selected from Group Which Consists of Physical Vacuum Evaporationo and Heat Vacuum Evaporationo, Chemical Vacuum Evaporationo, and Electron Beam Deposition, RF Deposition, and Pulse-ized Laser Deposition The method by the embodiment 5 acquired according to many stages of making both above CsX and aforementioned europium compound depositing on a substrate by ratio in which the CsX phosphor by which the europium compound was doped between 10-three to five-mol % is formed on the aforementioned substrate.
[0130] 8. It is Equipment for Reading Radiation Picture Memorized by Phosphorescence Screen in which Luminous Stimulus is Possible. - Radiation Source for Stimulus Arranged so that Light for Stimulus May be Given Off and the Aforementioned Light May be Turned on Phosphorescence Screen in which Luminous Stimulus is Possible, - Converter for Changing into Electrical Signal Light Which Came out of the Aforementioned Phosphorescence Screen on the Occasion of Stimulus, - It Has Elimination Unit for Eliminating Phosphorescence Screen in which the Aforementioned Luminous Stimulus is Possible after being Stimulated. - The aforementioned halogenide is the aforementioned reader in which a chloride and a bromide are one side at least, and the - aforementioned elimination unit has an electroluminescence lamp including the halogenation caesium phosphor by which the aforementioned screen was activated with the europium of two loads.
[0131] 9. Equipment by embodiment 8 changed so that aforementioned elimination unit might be equipped with array of light emitting diode.
[0132] 10. When the Aforementioned Phosphor is Selected from Group Which -X' Becomes from F, Cl, Br, and I, The europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX' is mixed with CsX between 10-three to five-mol %. - The embodiment 8 which burns this mixture at the temperature of 450 degrees C or more, and cools the - aforementioned mixture, and is acquired according to many stages of collecting -CsX:Eu phosphors, or equipment by 9.
[0133] 11. When the Aforementioned Screen is [-X'] Halogenide Selected from Group Which Consists of F, Cl, Br, and I, When the europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX' burns mixture with Above CsX between 10-three to five-mol %, the aforementioned CsX:Eu phosphor is prepared. - Equipment by the embodiment 10 acquired according to many stages which apply the aforementioned phosphor on a substrate by the method selected from the group which consists of physical vacuum evaporationo and heat vacuum evaporationo, chemical vacuum evaporationo, and RF deposition and

pulse-ized laser deposition.
[0134] 12. When it is Halogenide by Which the Aforementioned Phosphorescence Screen was Selected from Group Which X' Becomes from F, Cl, Br, and I in State for - Vacuum Evaporationo, The europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX', and the multiple container of Above CsX are brought about. - By Method Selected from Group Which Consists of Physical Vacuum Evaporationo and Heat Vacuum Evaporationo, Chemical Vacuum Evaporationo, and Electron Beam Deposition, RF Deposition, and Pulse-ized Laser Deposition Equipment by the embodiment 10 acquired according to many stages of making both above CsX and aforementioned europium compound depositing on a substrate by ratio in which the CsX phosphor by which the europium compound was doped between 10-three to five-mol % is formed on the aforementioned substrate.
[0135] It is Reusable Radiation Detector. 13. Phosphorescence Screen in which - Luminous Stimulus is Possible, - it Has been Arranged in order to Stimulate the Aforementioned Phosphorescence Screen -- at Least -- One Light Source for Stimulus -- - Array of Converter Element Arranged in order to Capture Light Which Came out of the Aforementioned Phosphorescence Screen on the Occasion of Stimulus and to Change the Aforementioned Light into Electrical Signal Expression, - Elimination Unit Equipped with Electroluminescence Lamp Arranged so that the Aforementioned Phosphorescence Screen May be Illuminated, when Excited, - Means for Conveying Assembly of Array of Light Source for Stimulus, Elimination Unit, and Converter Element about Phosphorescence Screen, - The detector possessing the interface means for [which encloses and communicates the - aforementioned electrical signal expression to an external signal processor] having surrounded the aforementioned means for conveying the phosphorescence screen in which the aforementioned luminous stimulus is possible, the light source for a stimulus, an elimination unit, the aforementioned assembly of the aforementioned array of a converter element, and the aforementioned assembly.
[0136] 14. The reusable radiation detector by the embodiment 13 changed so that the aforementioned elimination unit might be equipped with the array of light emitting diode.
[0137] 15. The embodiment 13 based on an inorganic electroluminescence phosphor in the aforementioned electroluminescence lamp, or the detector by 14.
[0138] 16. The embodiment 13 based on an organic electroluminescence phosphor in the aforementioned electroluminescence lamp, or the detector by 14.
[0139] 17. The reusable radiation detector of a chloride and a bromide the aforementioned phosphorescence screen is the halogenation caesium phosphor activated with the europium of two loads, and, on the other hand, the aforementioned halogenide comes out at least, and according to a certain embodiment 13 or 14.
[0140] 18. When the Aforementioned Phosphor is Selected from Group Which -X' Becomes from F, Cl, Br, and I, The europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX' is mixed with CsX between 10-three to five-mol %. - The detector by the embodiment 17 which burns this mixture at the temperature of 450 degrees C or more, and cools the - aforementioned mixture, and is acquired according to many stages of collecting -CsX:Eu phosphors.
[0141] 19. When the Aforementioned Phosphorescence Screen is [-X'] Halogenide Selected from Group Which Consists of F, Cl, Br, and I, A CsX:Eu phosphor is prepared when the europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX' burns mixture with Above CsX between 10-three to five-mol %. - The detector by the embodiment 17 acquired according to many stages which apply the aforementioned phosphor on a substrate by the method selected from the group which consists of physical vacuum evaporationo and heat vacuum evaporationo, chemical vacuum evaporationo, and RF deposition and pulse-ized laser deposition.
[0142] 20. When it is Halogenide by Which the Aforementioned Phosphorescence Screen was Selected from Group Which X' Becomes from F, Cl, Br, and I in State for - Vacuum Evaporationo, The europium compound selected from the group which consists of EuX'2, EuX'3, and EuOX', and the multiple container of Above CsX are brought about. - By Method Selected from Group Which Consists of Physical Vacuum Evaporationo and Heat Vacuum Evaporationo, Chemical Vacuum Evaporationo, and Electron Beam Deposition, RF Deposition, and Pulse-ized Laser Deposition The method by the embodiment 17 acquired according to many stages of making both above CsX and aforementioned europium compound depositing on a substrate by ratio in which the CsX phosphor by which the europium compound was doped between 10-three to five-mol % is formed on the aforementioned substrate.

[Translation done.]